



U.S. Department of Energy
Energy Efficiency and Renewable Energy

biomass program

Vision and Direction of the Biomass Program

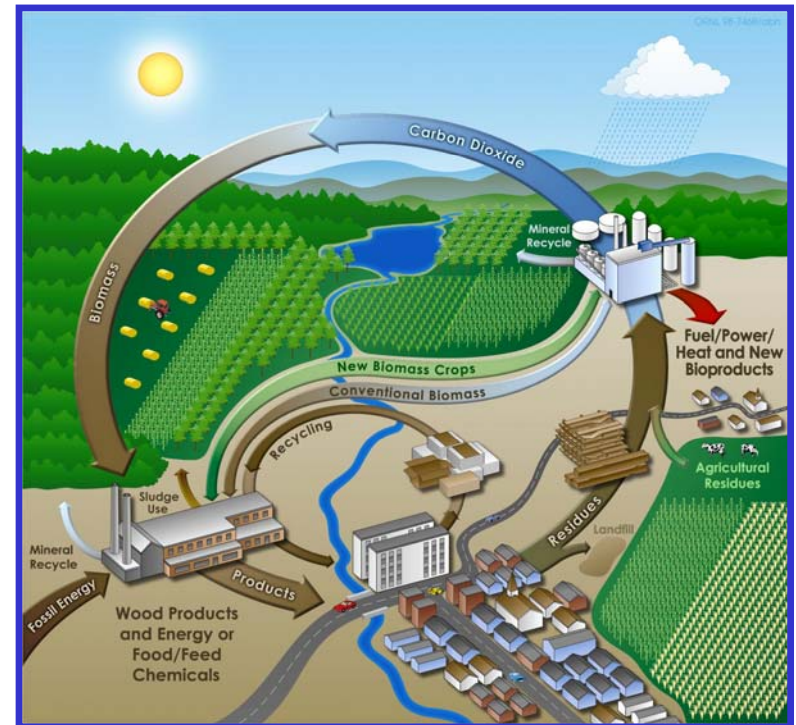
A photograph of Tom Foust, NREL Biomass Program Manager, standing in a field of tall, dry grass or crops. The sun is low in the background, creating a lens flare effect. The text "A Context for the DOE OBP Thermochemical Platform Review Meeting June 7-8, 2005" is overlaid on the image in yellow.

A Context for the
DOE OBP Thermochemical Platform
Review Meeting
June 7-8, 2005

Tom Foust
NREL Biomass Program Manager

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- Keeping our eye on the goal/mission
 - Energy security and sustainable energy
 - Petroleum Displacement
- **Long-Term** - Core R&D that addresses the main barriers towards development of the integrated thermochemical/biochemical biorefinery for large-scale production of liquid transportation fuels.
- **Deployment** – Partnerships with industry to deploy near term and mid term technologies aligned with the long-term objective.

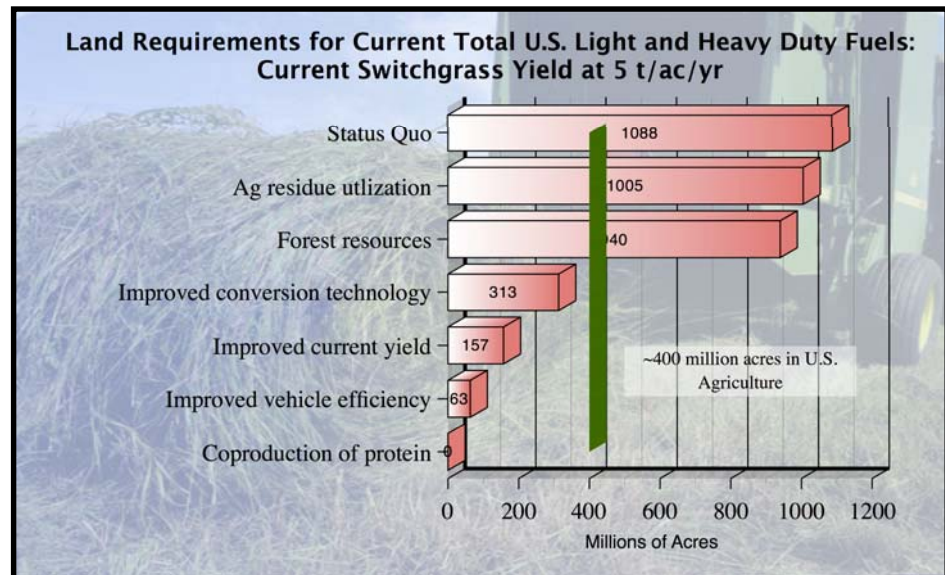
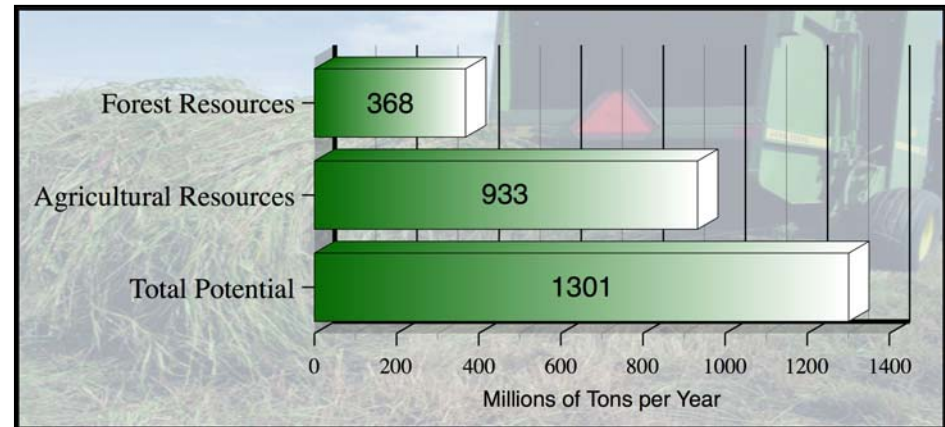




Keeping Our Eye on the Goal Biomass as a Major Energy Supply

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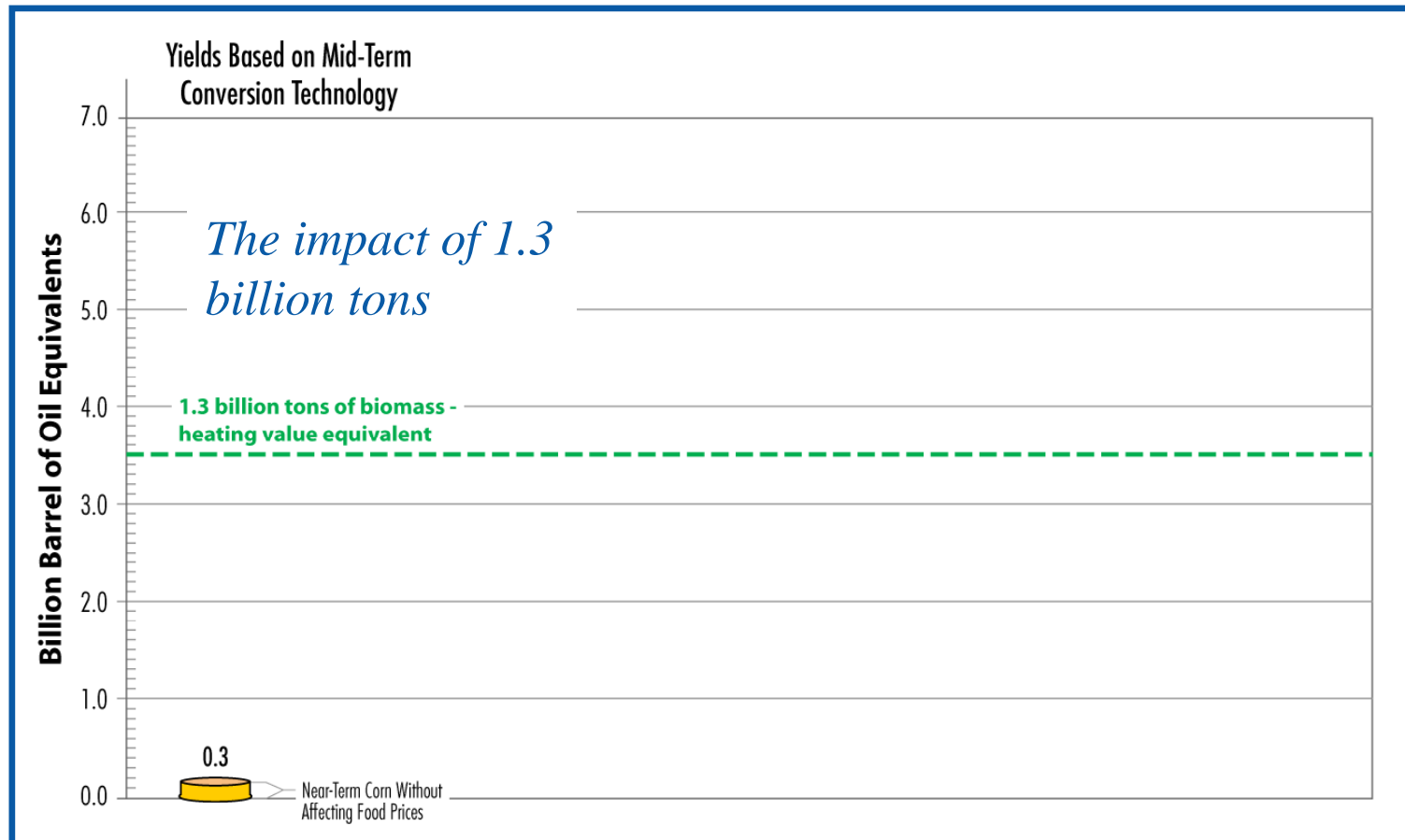
- Two independent studies have addressed the question of biomass supply
 - “Billion Ton Study” conservatively estimates a potential supply of 1.3 billion tons of biomass per year
 - “Role of Biomass Study” demonstrates the ability to meet current U.S. light duty and heavy duty transportation fuel demand using only 16% or less of current U.S. agricultural land





Keeping Our Eye on the Goal Biomass and Oil Displacement

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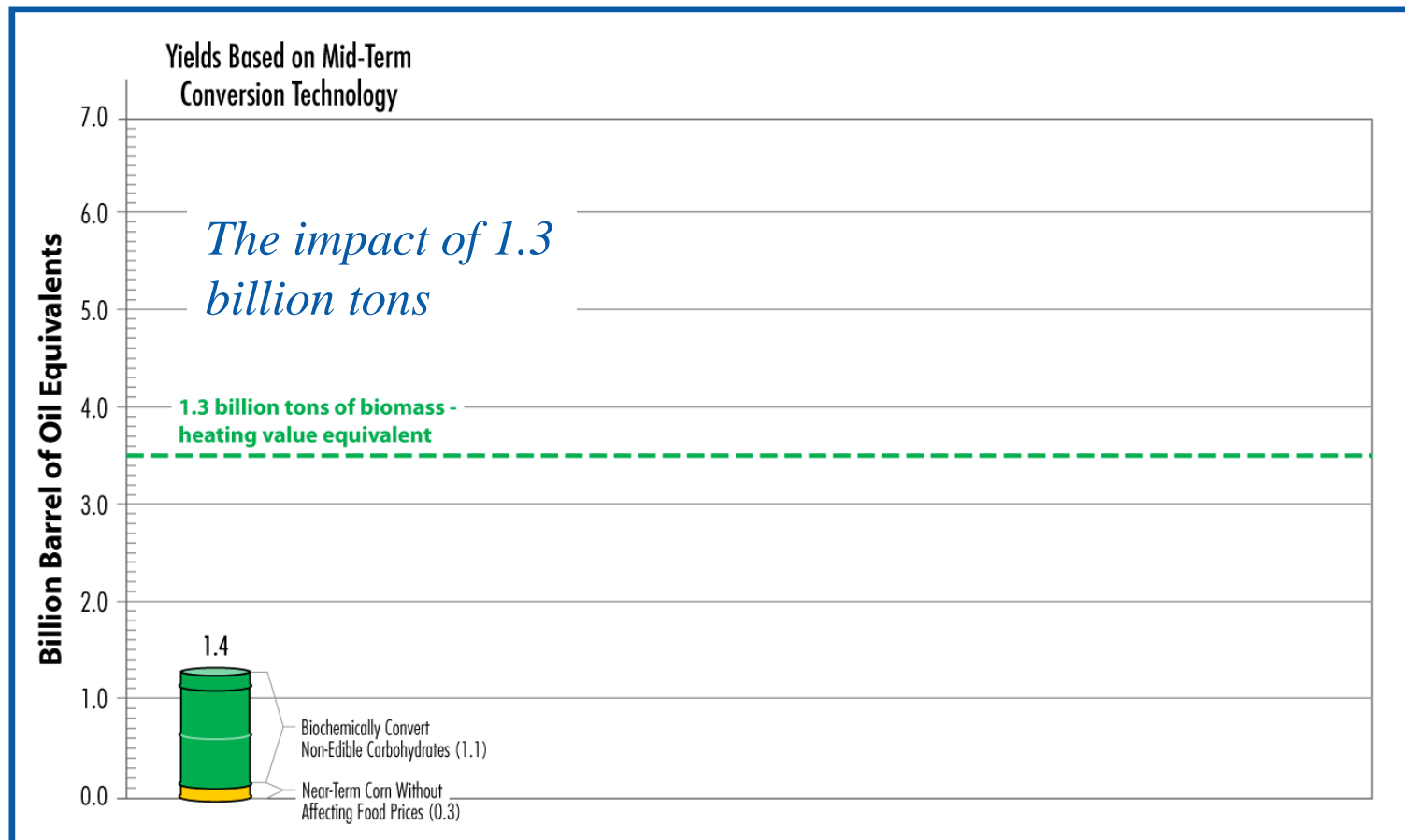




Keeping Our Eye on the Goal

Biomass and Oil Displacement

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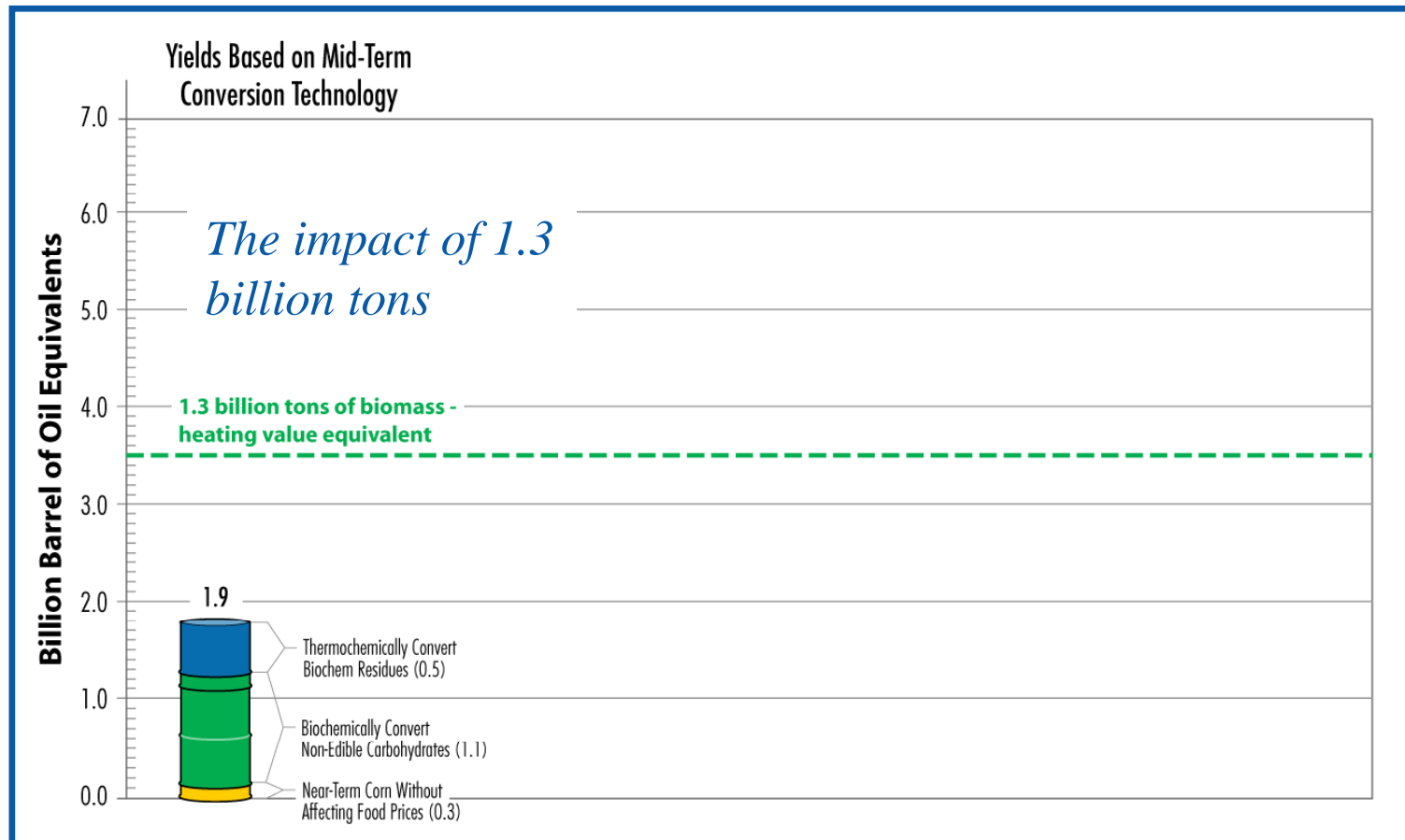




Keeping Our Eye on the Goal

Biomass and Oil Displacement

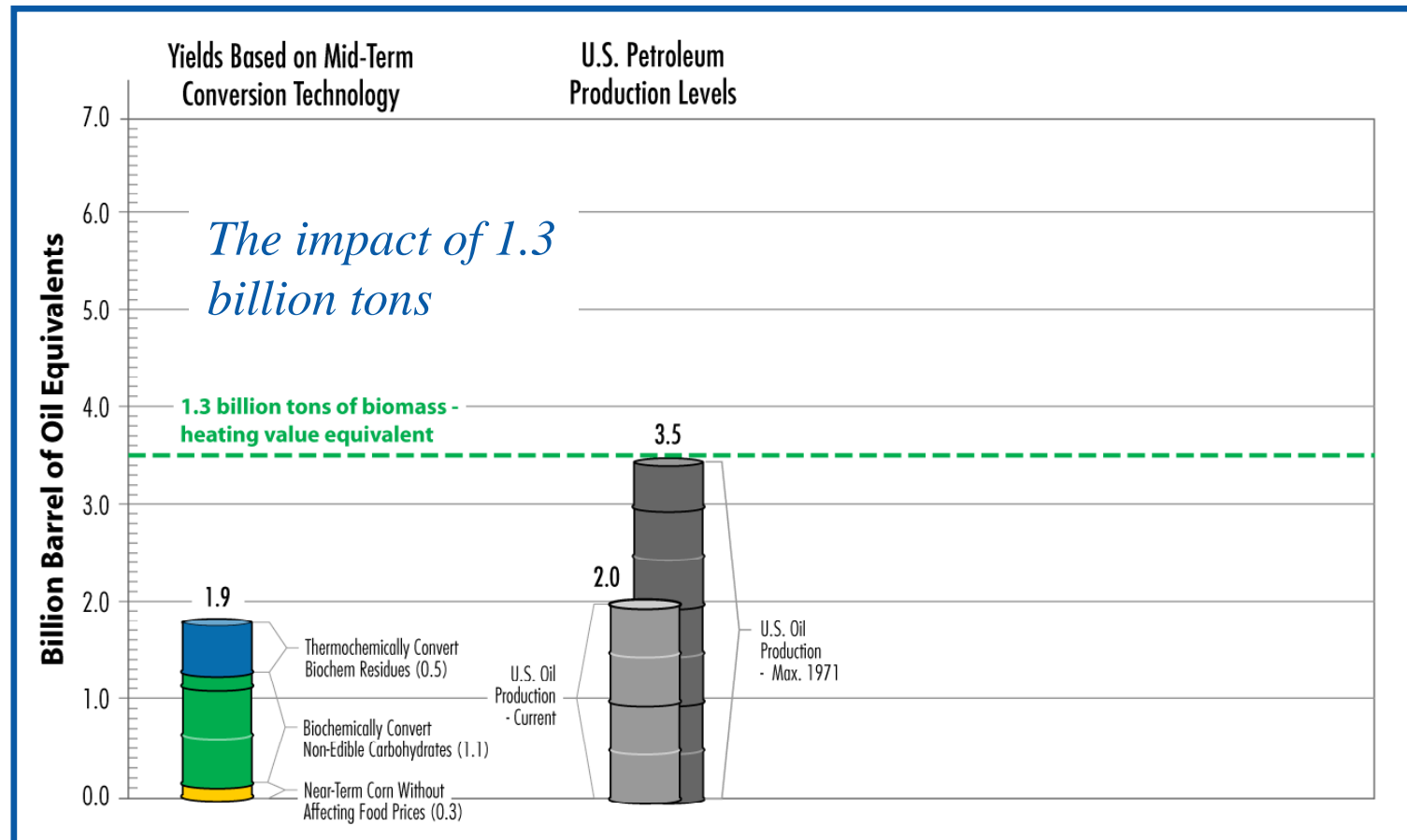
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Keeping Our Eye on the Goal Biomass and Oil Displacement

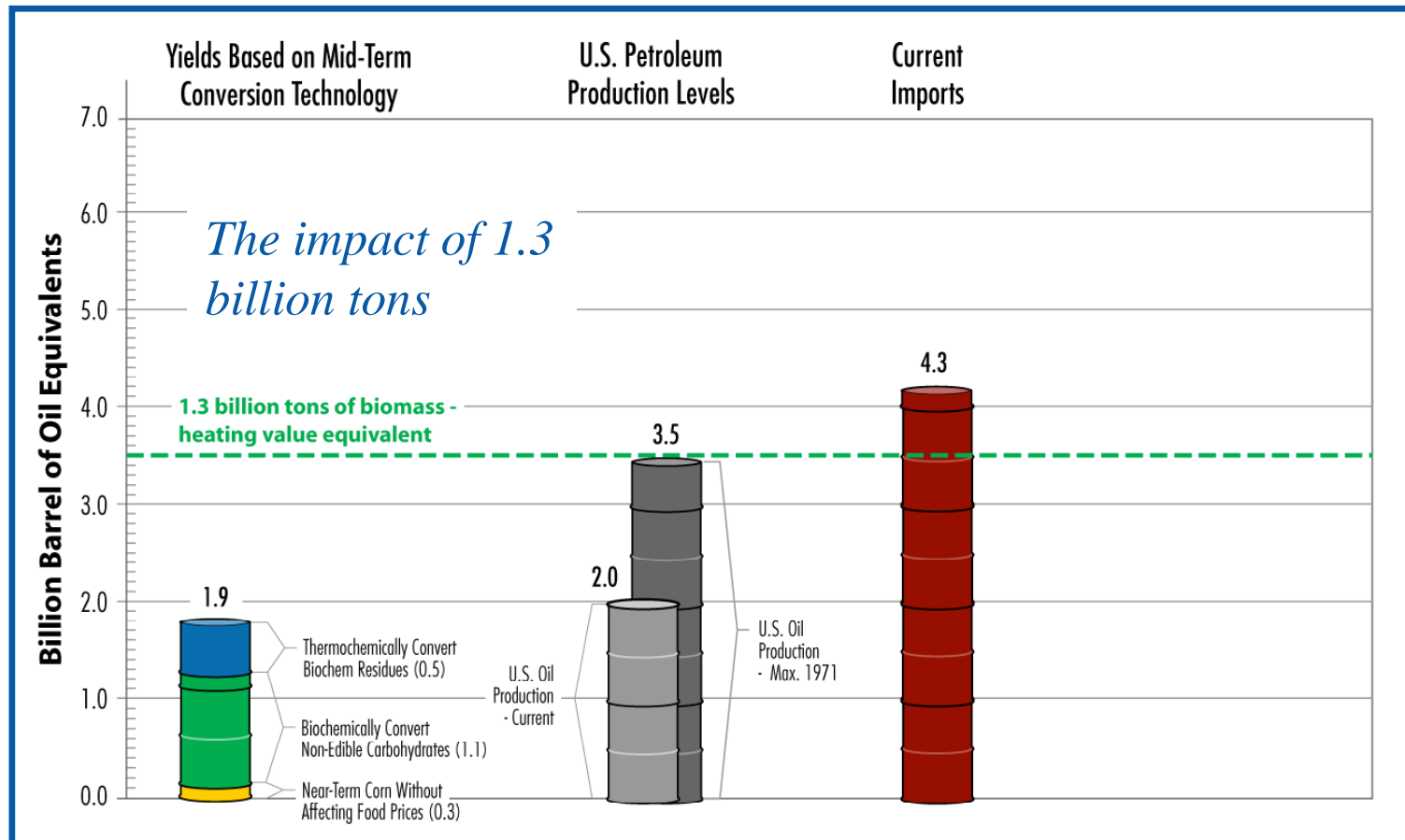
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Keeping Our Eye on the Goal Biomass and Oil Displacement

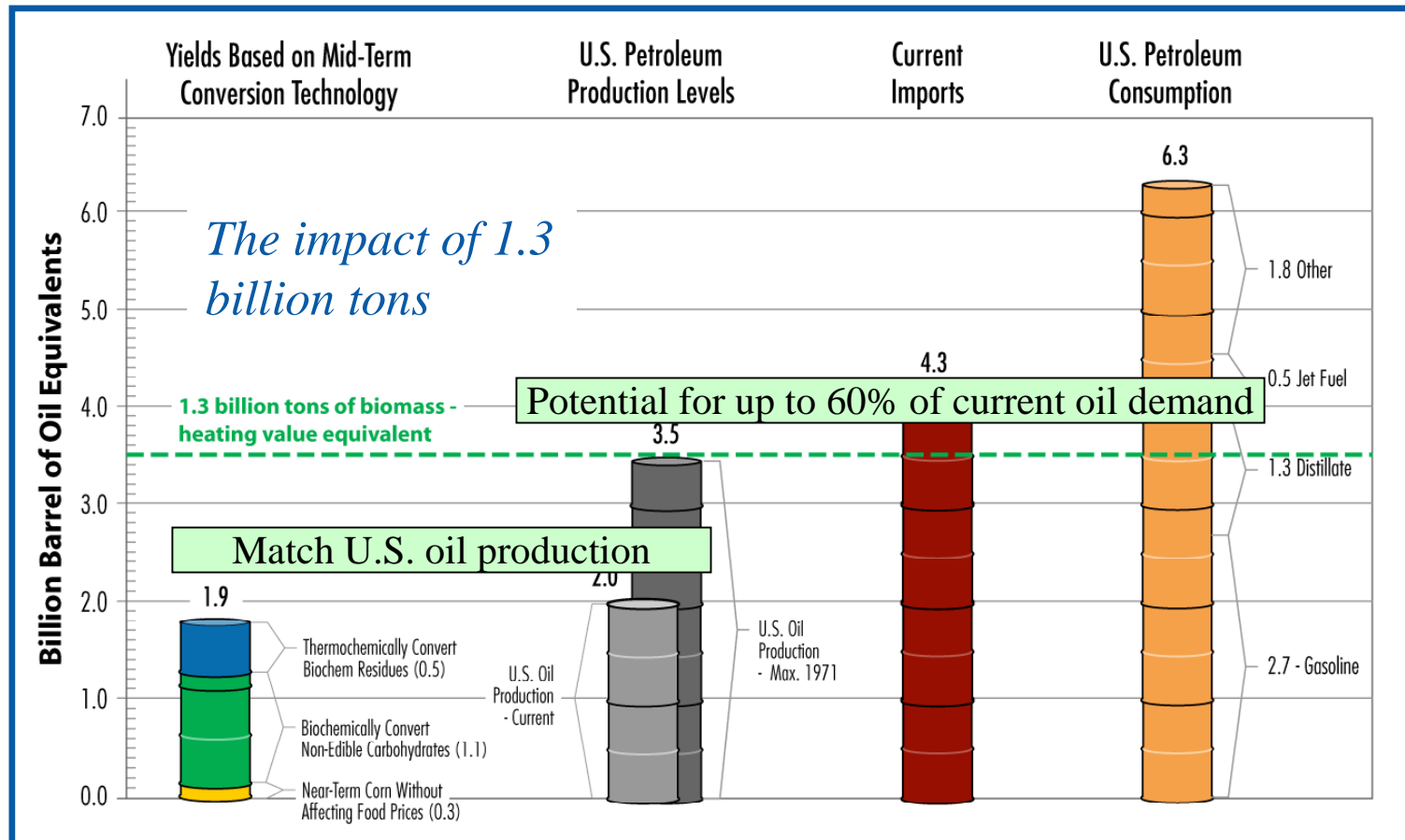
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Keeping Our Eye on the Goal Biomass and Oil Displacement

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Keeping Our Eye on the Goal Biomass and Oil Displacement

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So...assuming mid-term conversion technology, 1.3 billion tons of annual biomass supply could match today's U.S. oil production for liquid fuels

At efficiencies approaching that of mature petroleum refining, 1.3 billion tons of annual biomass is the equivalent of 60% of today's demand for petroleum in the U.S.

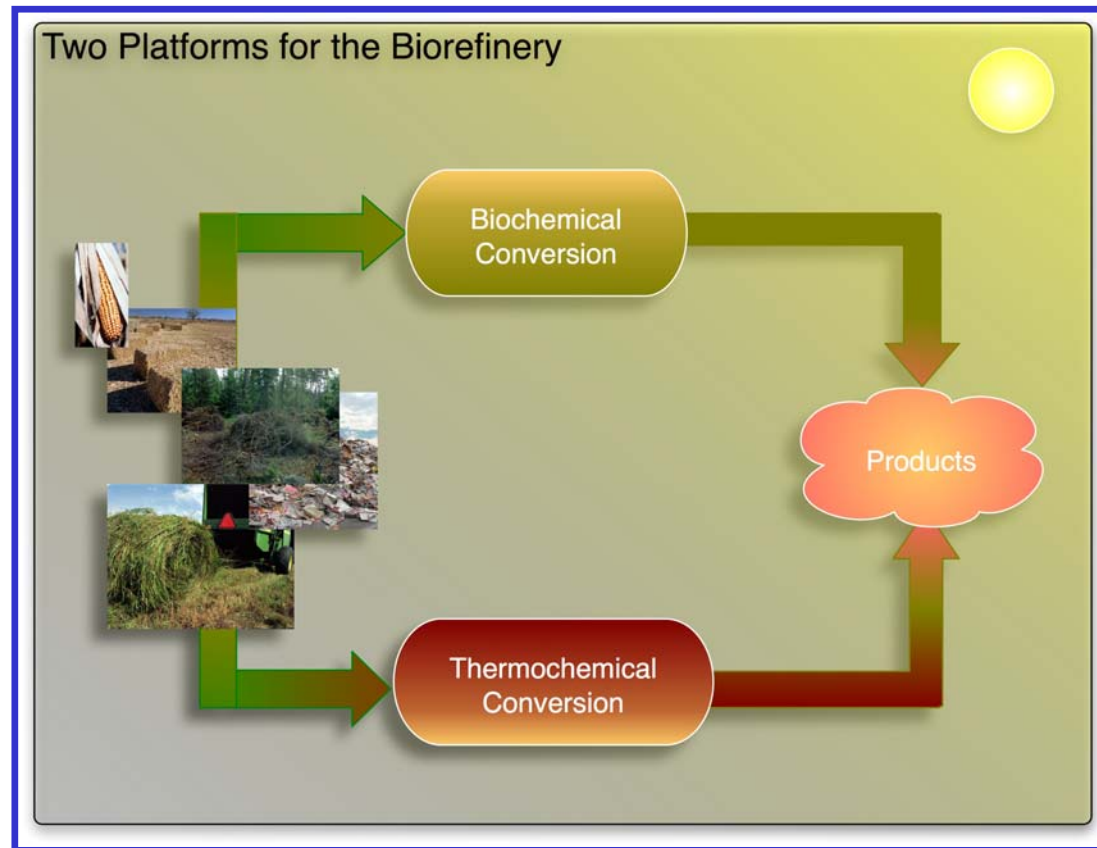
And, at efficiencies approaching that of mature petroleum refining, we could meet ALL of today's demand for light duty and heavy duty fuel in the U.S. using only 16% or less of U.S. ag land



Rethinking the Biorefinery

An Evolving Vision

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Separate
technologies

Thermochemical
technology for
combined heat and
power

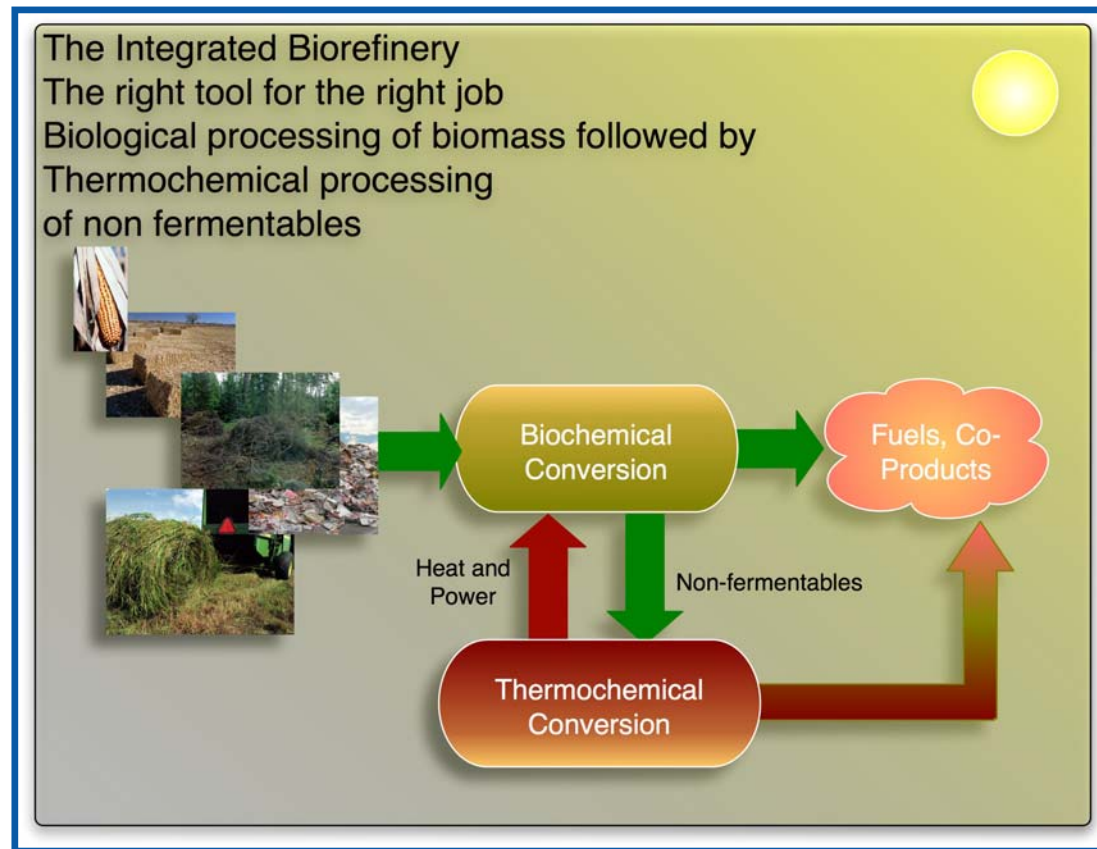
Biochemical
technology for
ethanol and power



Rethinking the Biorefinery

An Evolving Vision

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Today we see that the mature integrated biorefinery *must* include biological *and* thermochemical conversion

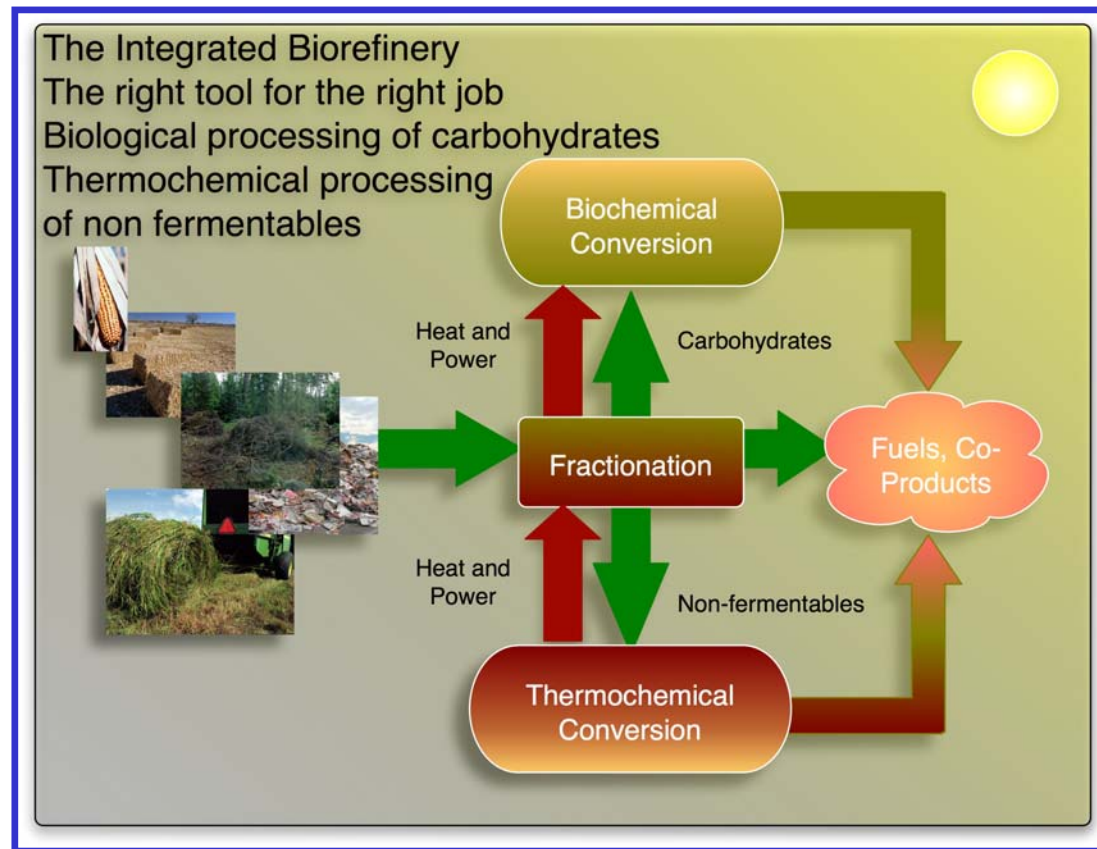
Maximize efficiency of biomass (and land) utilization by producing fuels thermochemically and biologically



Rethinking the Biorefinery

An Evolving Vision

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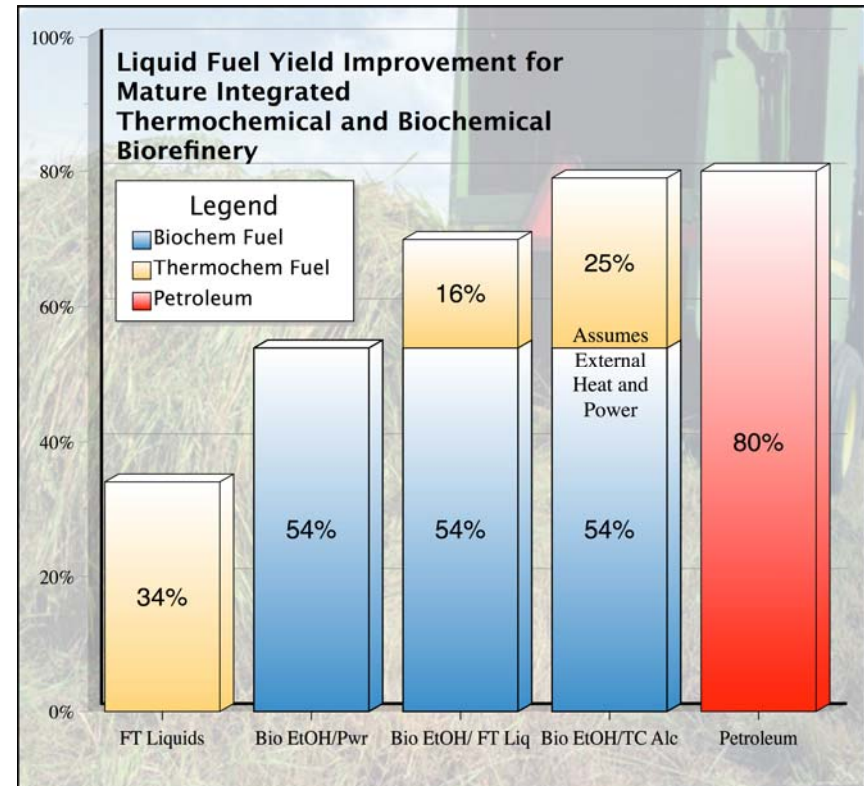
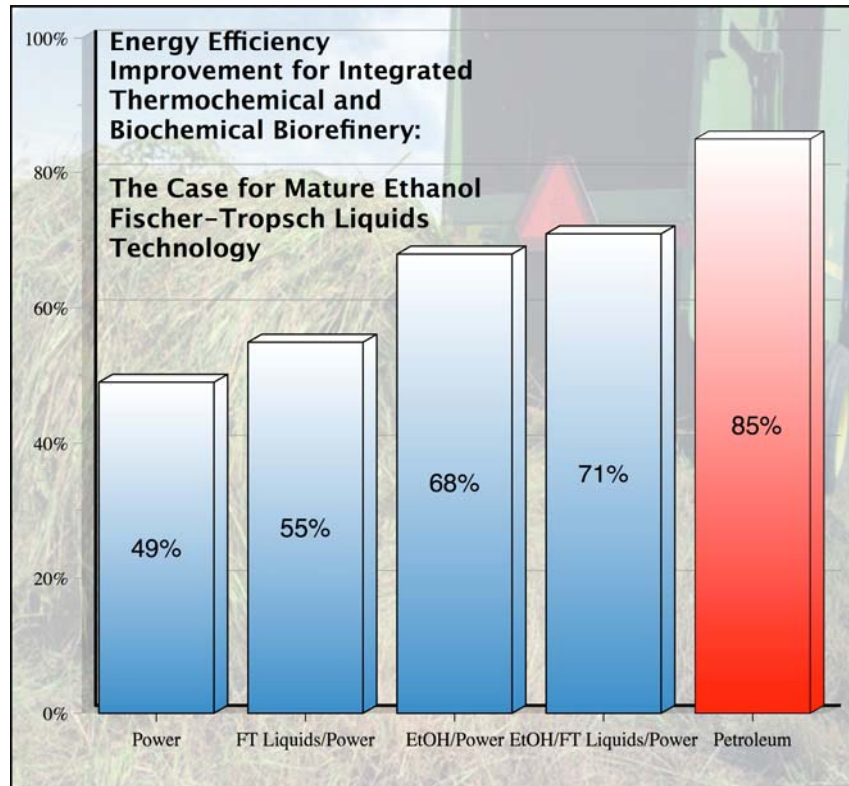


Biomass as
“The New
Petroleum”—and
then some
Source of food,
feed, fiber, fuels
and chemicals



Rethinking the Biorefinery Maximizing Energy Efficiency

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“Role of Biomass” Project: Energy efficiency is maximized for integrated thermochemical and biochemical process technologies

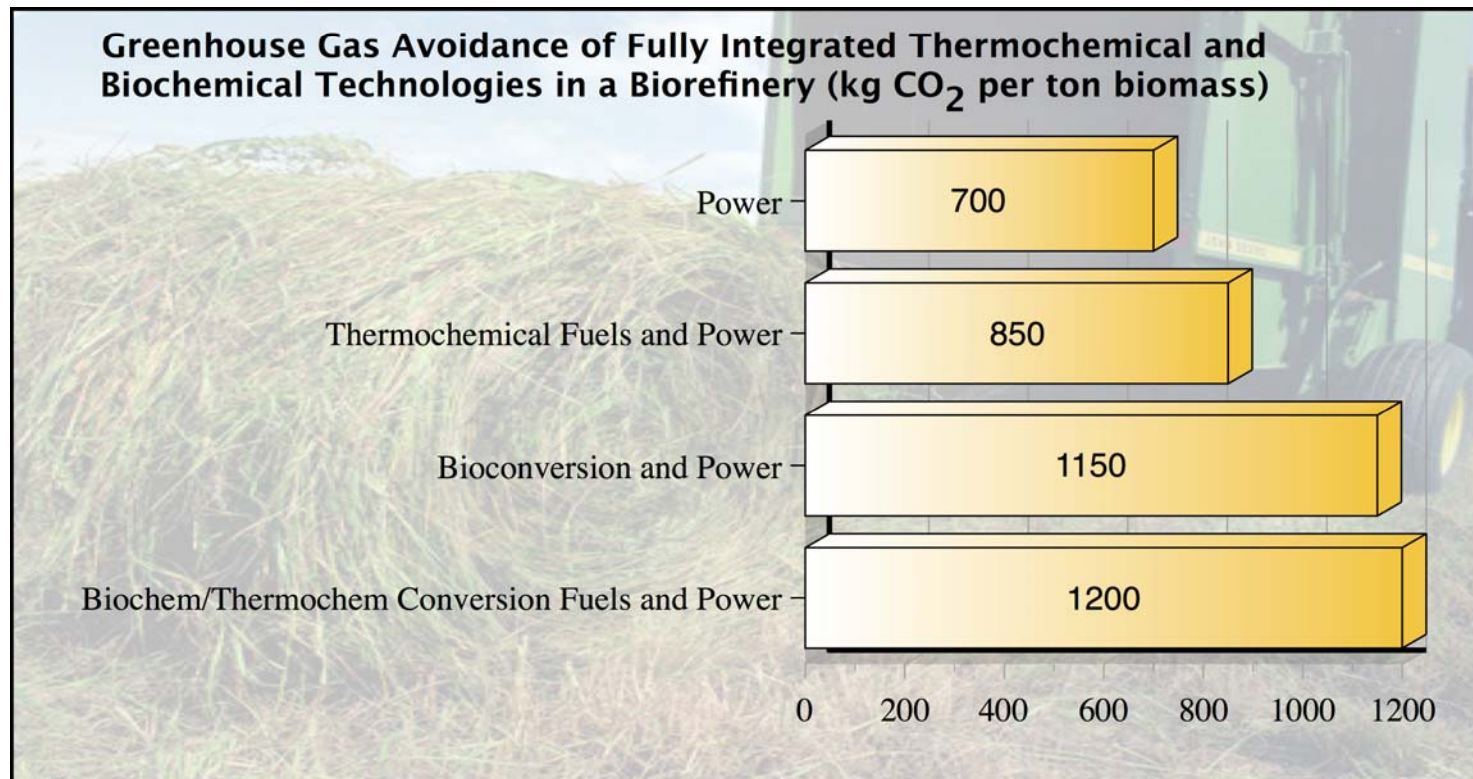
The same is true for liquid fuels production

If heat and power for the process are provided externally (not from biomass), it is possible to approach liquid fuel yields of today’s petroleum refineries on an energy basis



Rethinking the Biorefinery Greenhouse Gas Emissions

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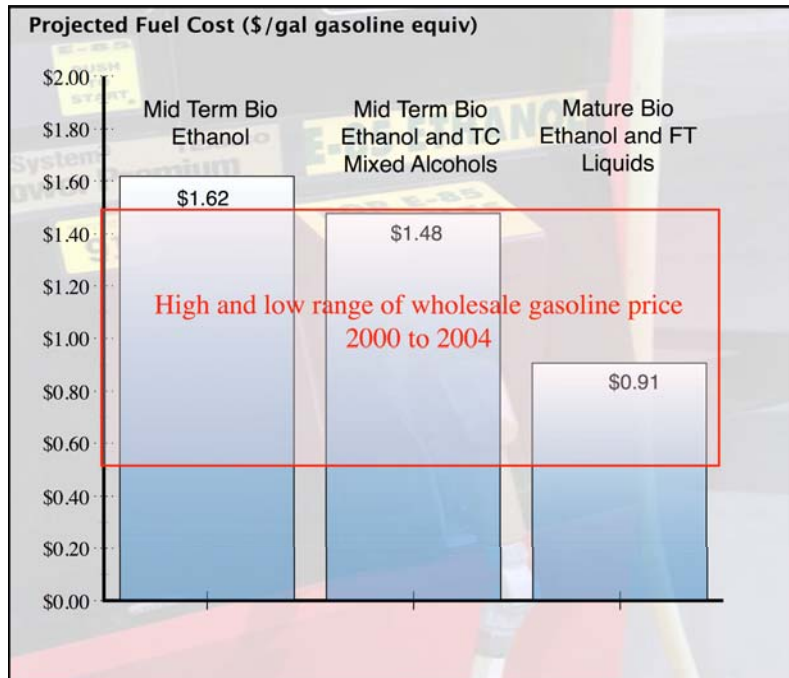


For future scenarios where U.S. power production includes substantial renewable energy sources, integrated thermochemical and biochemical technologies maximize benefits of greenhouse gas emissions



Rethinking the Biorefinery Market Competitiveness

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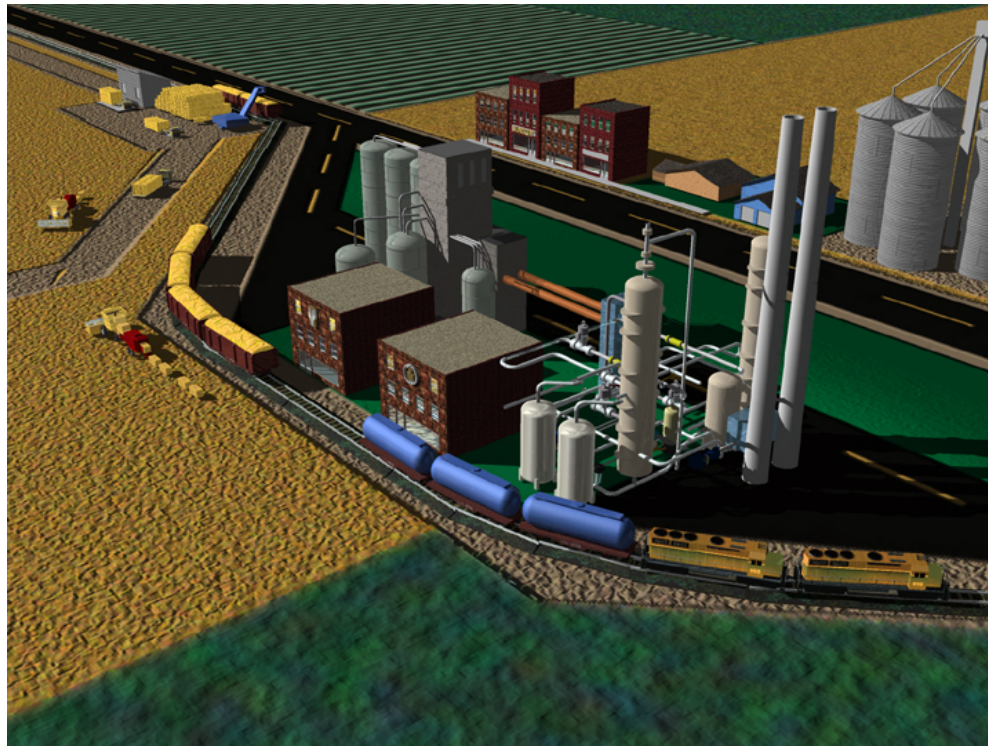


New analyses of combined thermochemical and biochemical processes show opportunity for achieving competitiveness with gasoline in the long run



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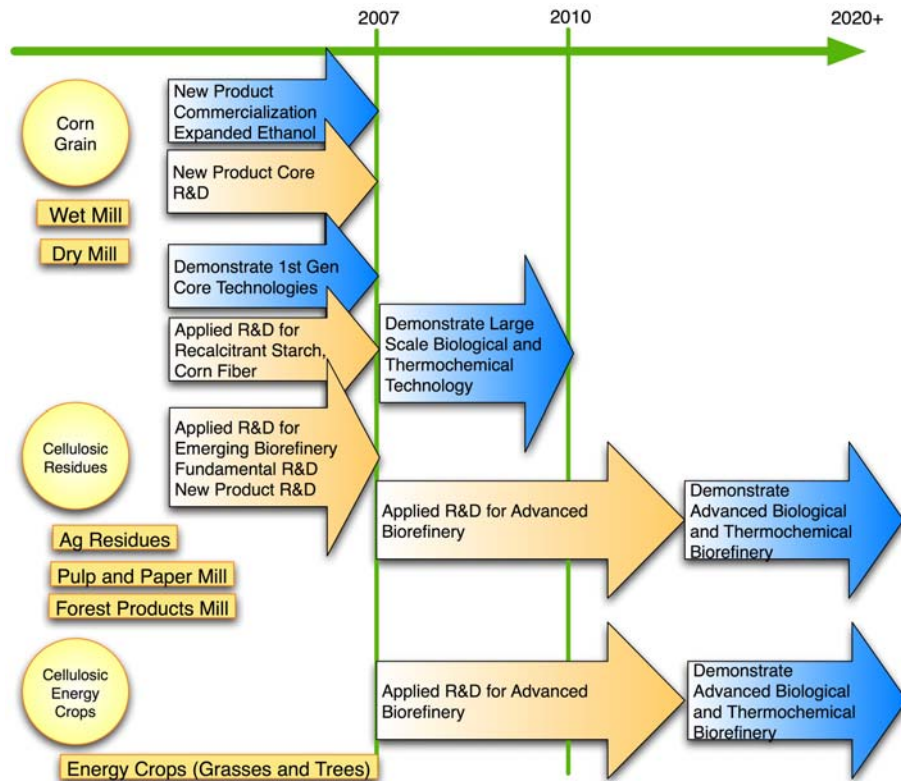
Energy efficiency, greenhouse gas emissions and economics all point us toward a long term vision of the biorefinery that combines mature biological and thermochemical technology





The Biorefinery The Path Forward

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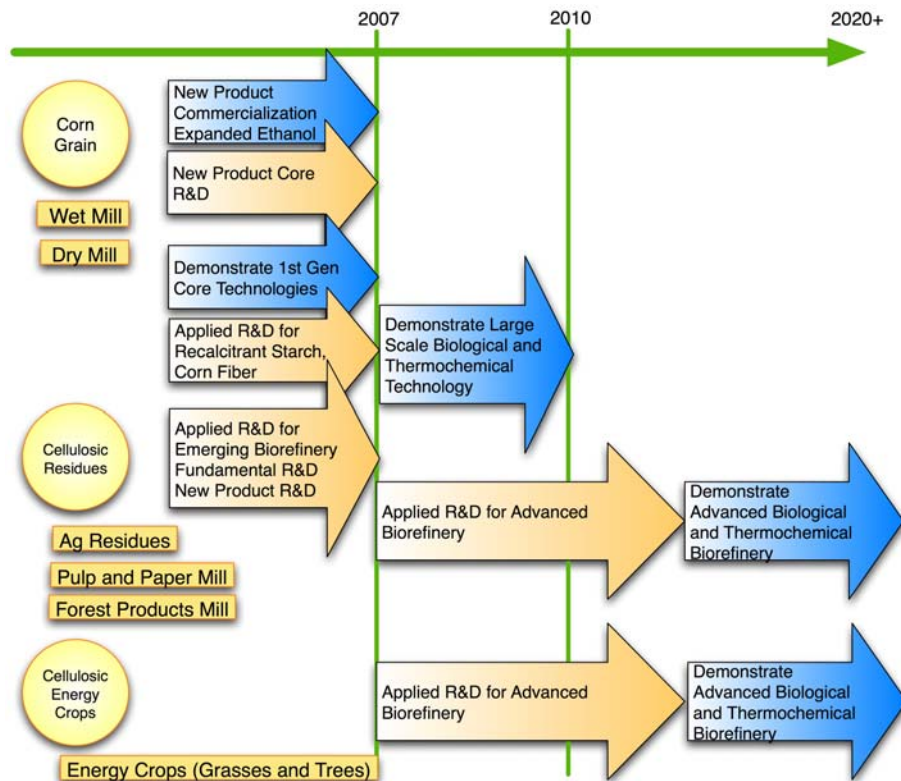


- Six pathways represent possible homes for deployment of new technology
- Three major areas:
 - Existing Corn Ethanol Industry
 - Emerging Industry for Residues
 - New Bioenergy Crops



The Biorefinery The Path Forward

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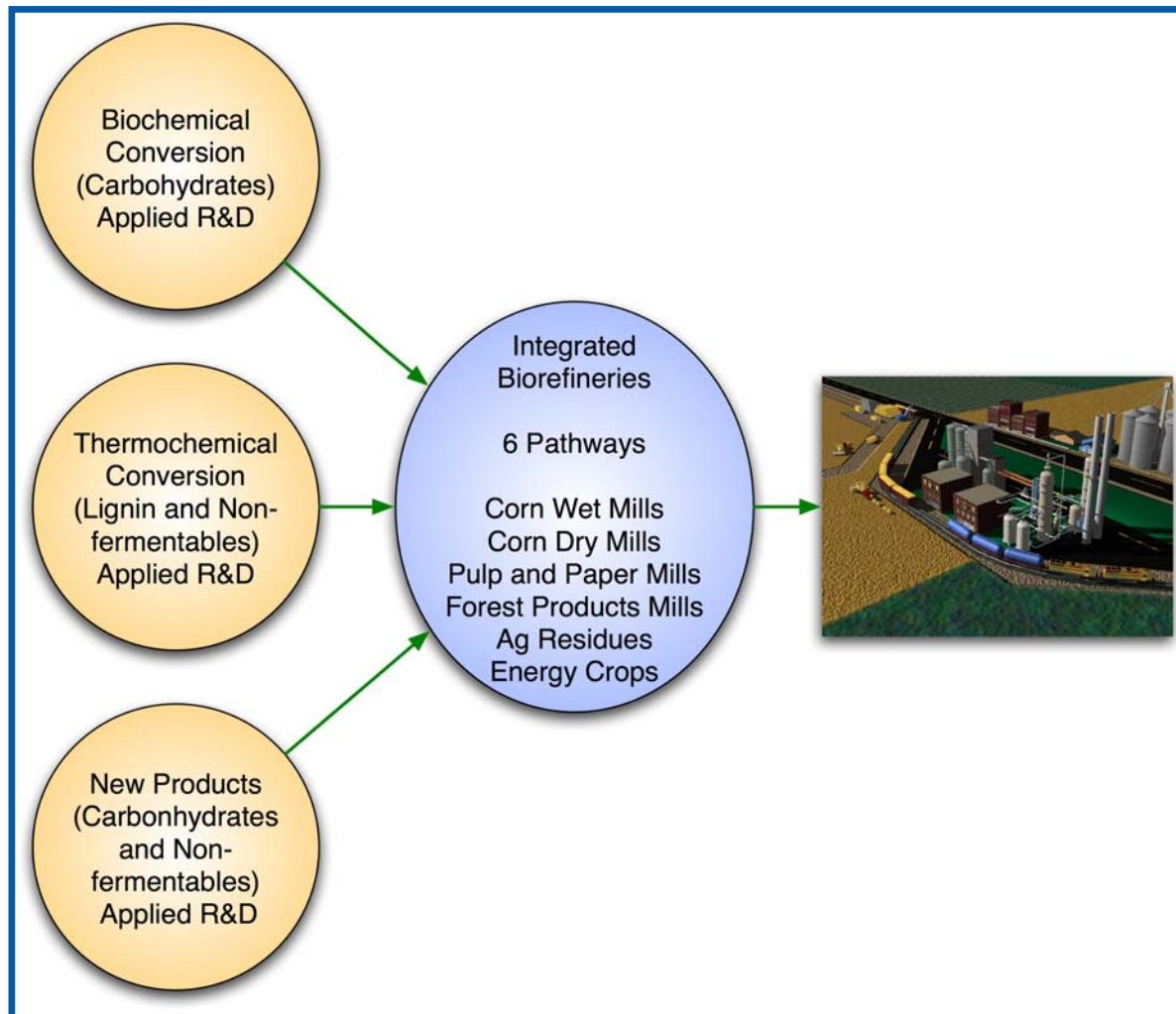
Three strategies

1. Seed new technology components in existing facilities by 2007
2. Scale up 1st generation cellulosic biomass processing by 2012 (FY 08 Solicitation)
3. Develop advanced biological/ thermochemical process that support large scale displacement of petroleum by 2020+



The Role of Program R&D

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Thermochemical Platform Economic Analysis

- Pam Spath

Thermochemical Processing Session

- Don Stevens

Syngas Clean-up and Conditioning Session

- Rich Bain